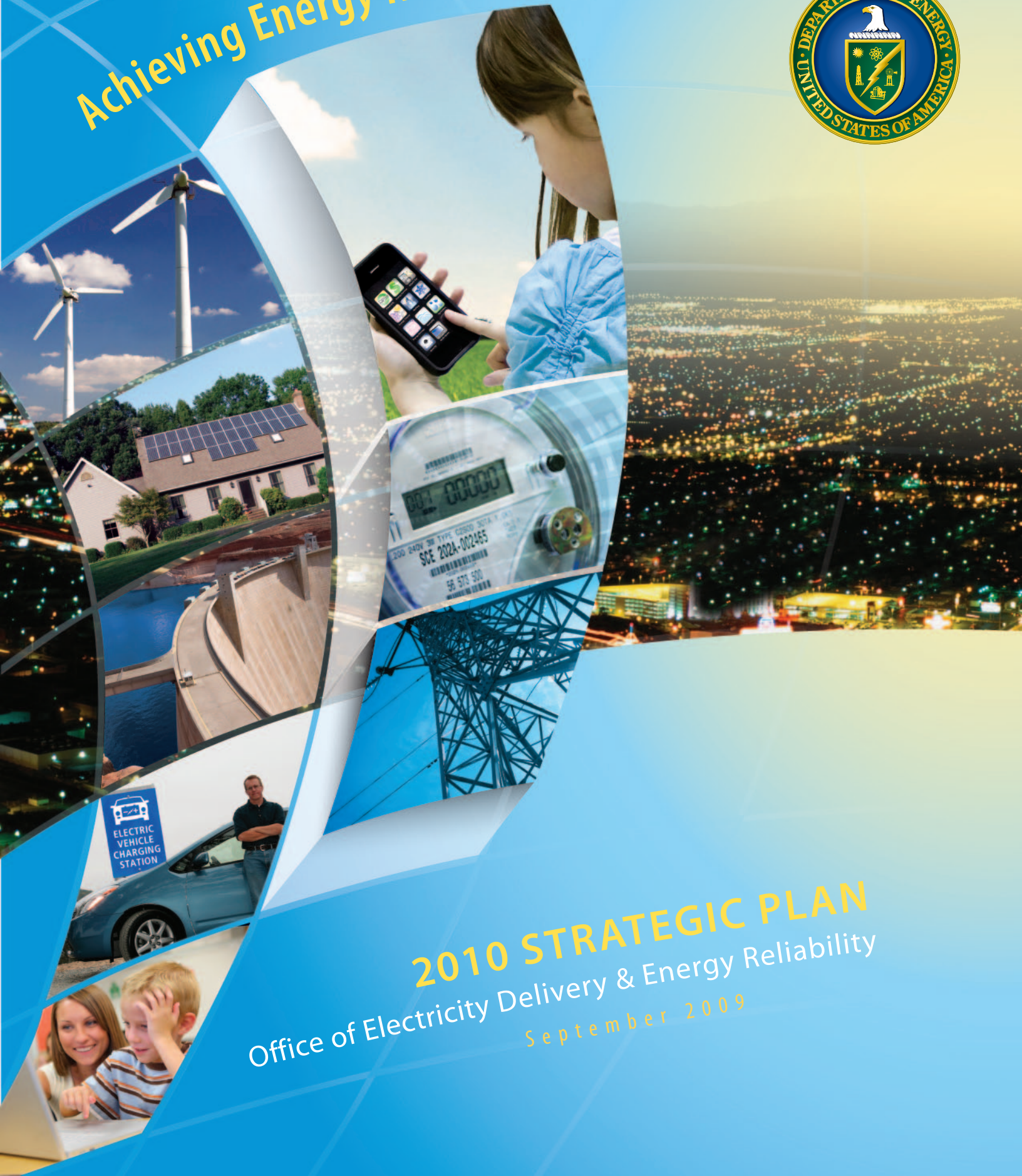
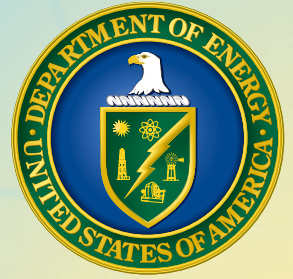


Achieving Energy Reliability Together.



2010 STRATEGIC PLAN
Office of Electricity Delivery & Energy Reliability
September 2009

OE's Declaration:

APPLY SCIENCE AND TECHNOLOGY BREAKTHROUGHS
TO EMPOWER CONSUMERS AND ACHIEVE AN
AFFORDABLE, RELIABLE, SECURE AND SUSTAINABLE
NATIONAL ENERGY SUPPLY

A modern, reliable, secure, affordable and environmentally sensitive national energy infrastructure is fundamental to our quality of life and energy future.

Yet, since 1982, growth in peak demand for electricity has exceeded the growth and development of our electric grid. This demand growth will continue due to a growing population; larger homes with burgeoning IT requirements and more elaborate appliances; and the growth of electric vehicles; as well as, the day-to-day energy required to power our hospitals, schools, industries and other necessities of life. The electricity we use today is delivered via an electric infrastructure built with 19th and 20th century technologies which are inadequate to keep pace with or accelerate the growth of a 21st century economy. Key examples of this are the issues associated with two-way power flows, intermittency, and high penetrations of renewables. Historically, underinvestment in the electricity transmission and distribution systems has weakened the supply, efficiency and reliability of the Nation's electricity. A consequence of this weakening impact is the resultant power quality issues that are estimated to cost American business more than \$100 billion on average each year. Furthermore, severe weather and other events persistently disrupt electricity, particularly at the local level. These constraints and the continual vulnerability to disruptions — from severe weather and a variety of other causes — impact more people and cost more money today than at any time in our history. For these and other reasons, a long-term commitment to expanding and improving the energy infrastructure is integral to our Nation's progress.

With the passage of the American Recovery and Reinvestment Act on February 17th, 2009, President Barack Obama declared America's commitment to moving toward a new, clean energy future. Under the Recovery Act, the Office of Electricity Delivery and Energy Reliability (OE) will make historic strides in the development and deployment of new, primarily Smart Grid technologies that will better equip our energy infrastructure to manage current and future demands. OE will help lead efforts that will not only ensure greater reliability and capacity of the grid, but also ensure the security and resiliency of our energy supply against natural disasters and man-made threats.

America's new energy economy, based upon scientific discovery and innovation, emphasizes the preservation of a healthy environment and better management of available resources, including greater integration of renewable energy sources, thereby reducing our dependence on foreign oil. Equally important, this new economy will foster expanded partnerships and collaboration with a wide range of stakeholders and encourage participation of the American public, through progressive policy development, education, expanded energy-related choices and the creation of a green energy workforce that will advance jobs of the future and our Nation's global competitiveness.

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This plan reflects OE's ongoing development of a strategy to achieve the Secretary's vision of an affordable, reliable, secure and sustainable national energy supply. OE will continue to improve this plan through stakeholder input and senior management leadership.

The Office of Electricity Delivery and Energy Reliability (OE) will play a central role in revolutionizing the Nation's energy infrastructure and transforming the way we live, including impacting the economy, national security and environment.

In recognition of the importance of infrastructure modernization, Energy Secretary Steven Chu stated, "... the future Smart Grid... is very important because it is seen as a major key part of the economic recovery of the United States. This will instantly create many jobs as we rebuild and modernize the grid system and is also laying the foundation of our future prosperity."


To truly solve the energy challenge requires that we effectively generate, transmit and distribute energy. At the core of OE's responsibilities is the development of Smart Grid technology and a modernized transmission system that will enable the transmission and distribution of renewable and other forms of generation. This system will enable a more reliable, efficient, interactive energy delivery system that will transform the way we use energy.

Think of how our interstate highway system transformed the way we travel, commute to work, ship food and other essentials, and receive medical care, improving the quality of life beyond people's imagination. OE envisions an equally transformational leap in the energy infrastructure, energy management, and the electric grid that empowers Americans. Benefits include:

- The involvement of consumers, utilities, grid transmission operators and other power stakeholders in digital, Smart Grid, multi-directional communication and controls that dramatically improve energy usage, including remote monitoring and control of real-time energy pricing and usage in our homes;
- Participation of consumers in energy generation and profits;
- Dramatic expansion in our choices of supply side generation options, including local generation and clean, renewable energy sources that will reduce carbon emissions and the threat of climate change;
- Widespread use of plug-in electric and hybrid electric vehicles that can be re-charged at home and potentially supply the grid with electricity;
- Job proliferation of the new age green energy workforce.

OE also foresees a robust, resilient energy infrastructure in which continuity of business and services is maintained through secure and reliable information sharing, effective risk management programs, coordinated response capabilities, and trusted relationships between public and private security partners at all levels of industry and government.





OE's Mission & Structure: In partnership with the energy industry, national laboratories, universities and other Federal agencies, State, Tribal, local governments and international partners - OE will *“Lead national efforts to modernize the electric grid; enhance security and reliability of the energy infrastructure; and mitigate the impact of, and facilitate recovery from, disruptions to the energy supply.”*

To achieve this, OE combines three broad and distinct, yet mutually reinforcing, activities — research and development, permitting and analysis, and emergency response. This combination of activities is unique within DOE, and it affords the office a broad capability to address overarching issues with regards to the Nation's energy infrastructure.

The office is organized into three programmatic divisions around these activities — Infrastructure Security and Energy Restoration (ISER); Permitting, Siting and Analysis (PSA); and Research and Development (R&D) — as well as, the Corporate Business Operations (CBO) Division, which provides business and administrative support. These divisions collectively collaborate with Federal, State and local officials, and energy stakeholders throughout the country and internationally to ensure that the Nation's energy delivery system is secure, resilient and reliable.

OE's Infrastructure Security and Energy Restoration (ISER) Division works with other Federal agencies, States, local government and the private sector to ensure the Nation's continuous and reliable energy supplies, and the restoration and recovery of supplies when preventive measures fail.

The Permitting, Siting and Analysis (PSA) Division facilitates the permitting and siting of transmission lines, and development of programs that allow the electric grid to operate more reliably and efficiently.

The Research and Development (R&D) Division partners with industry, government, national laboratories and universities to advance technologies that will meet the Nation's need for a reliable, efficient and resilient electric power grid, as well as improved accessibility to a variety of energy sources for generation, including renewable energy resources.

The Corporate Business Operations (CBO) Division provides administrative expertise and business operation services to all three divisions in the collaborative pursuit of OE's Mission. This includes strategic planning, budget formulation and execution, financial oversight, performance management and reporting, information technology, human capital, and general administrative support.

This Strategic Plan — built upon our Strategic Goals, Objectives and Performance Targets — reflects the Office's continuous and determined efforts to find the best pathway to meeting the Nation's most urgent energy needs of today and tomorrow. It also reflects OE's enduring commitment to transparency and accountability as it partners with stakeholders and the American public to realize the vision of energy independence.



Empower the Energy

WITH...

KNOWLEDGE

DIVERSITY

INDEPENDENCE

CHOICE





Energy Consumer

DEPENDABILITY

POWER TO
GENERATE
ELECTRICITY

**JOIN OE IN THE STRATEGIC
JOURNEY TO TRANSFORM OUR
ENERGY FUTURE.**

DOE'S SECRETARIAL OBJECTIVES, ACCOUNTABILITY CASCADE

Secretary Chu, in one of his first actions, laid out his five strategic objectives for the Department. The five Secretarial objectives are: 1) Science, Discovery and Innovation; 2) Clean Secure Energy; 3) Economic Prosperity; 4) Lower GHG Emissions; and 5) National Security and Legacy ¹. Building upon the first four objectives, the Office of Electricity Delivery and Energy Reliability developed OE's Strategic Goals, Program Level Goals and Objectives. In addition to the five Secretarial Objectives, OE is leading through its commitment to achieving Management Excellence ², which supports all of the secretarial objectives.

SCIENCE, DISCOVERY AND INNOVATION: Invest in Science to Achieve Transformational Discoveries.

- OE's STRATEGIC GOAL 1: Develop market-deployable advanced electric transmission and distribution technologies and facilitate expansion of our Nation's electricity infrastructure capacity in order to enhance the adaptability, capacity, reliability, and resiliency of the electric system and promote a low-carbon environment.

CLEAN SECURE ENERGY: Change the Landscape of Energy Demand and Supply.

- OE's STRATEGIC GOAL 1: Develop market-deployable advanced electric transmission and distribution technologies and facilitate expansion of our Nation's electricity infrastructure capacity in order to enhance the adaptability, capacity, reliability, and resiliency of the electric system and promote a low-carbon environment.
- OE's STRATEGIC GOAL 2: Identify, prioritize, coordinate, and improve the protection and restorative capability of national and international critical energy infrastructure assets and key resources — including relevant cyberspace assets — with improved situational awareness, analysis, planning and preparation; advanced electric transmission and distribution technologies; and expansion of the electricity infrastructure.

ECONOMIC PROSPERITY: Create Millions of Green Jobs and Increase Competitiveness.

- OE's STRATEGIC GOAL 3: Help build a workforce capable of modernizing the electric grid.

LOWER GHG EMISSIONS: Position U.S. to Lead on Climate Change Policy, Technology, and Science.

- OE's STRATEGIC GOAL 1: Develop market-deployable advanced electric transmission and distribution technologies and facilitate expansion of our Nation's electricity infrastructure capacity in order to enhance the adaptability, capacity, reliability, and resiliency of the electric system and promote a low-carbon environment.

NATIONAL SECURITY AND LEGACY ¹: Maintain Nuclear Deterrent and Prevent Proliferation.

MANAGEMENT EXCELLENCE ²: Champion Best Practices to Achieve Mission Critical Goals.

- OE's STRATEGIC GOAL 4: Champion best practices that promote effective, transparent and responsible use of limited resources and facilitate and/or enable achievement of mission-critical goals.

¹ Currently OE does not have a direct role in supporting this objective.

² Management Excellence is not an official DOE Secretarial Objective, but OE is leading through its commitment to achieving Management Excellence, which supports all of the secretarial objectives.

OE'S GOALS AND THE STRATEGIC

OE's Strategic Accountability Cascade underscores how individual performance plans are tied to DOE's and OE's goals. This reflects how we strive to maintain alignment between each staff member's day-to-day work and the overarching imperatives of the Department. The pyramid shape illustrates how the OE's individual performance plans serve as the foundation for DOE's mission of "Discovering the solutions to power and secure America's future."

Mission

The Office of Electricity Delivery and Energy Reliability leads national efforts to:

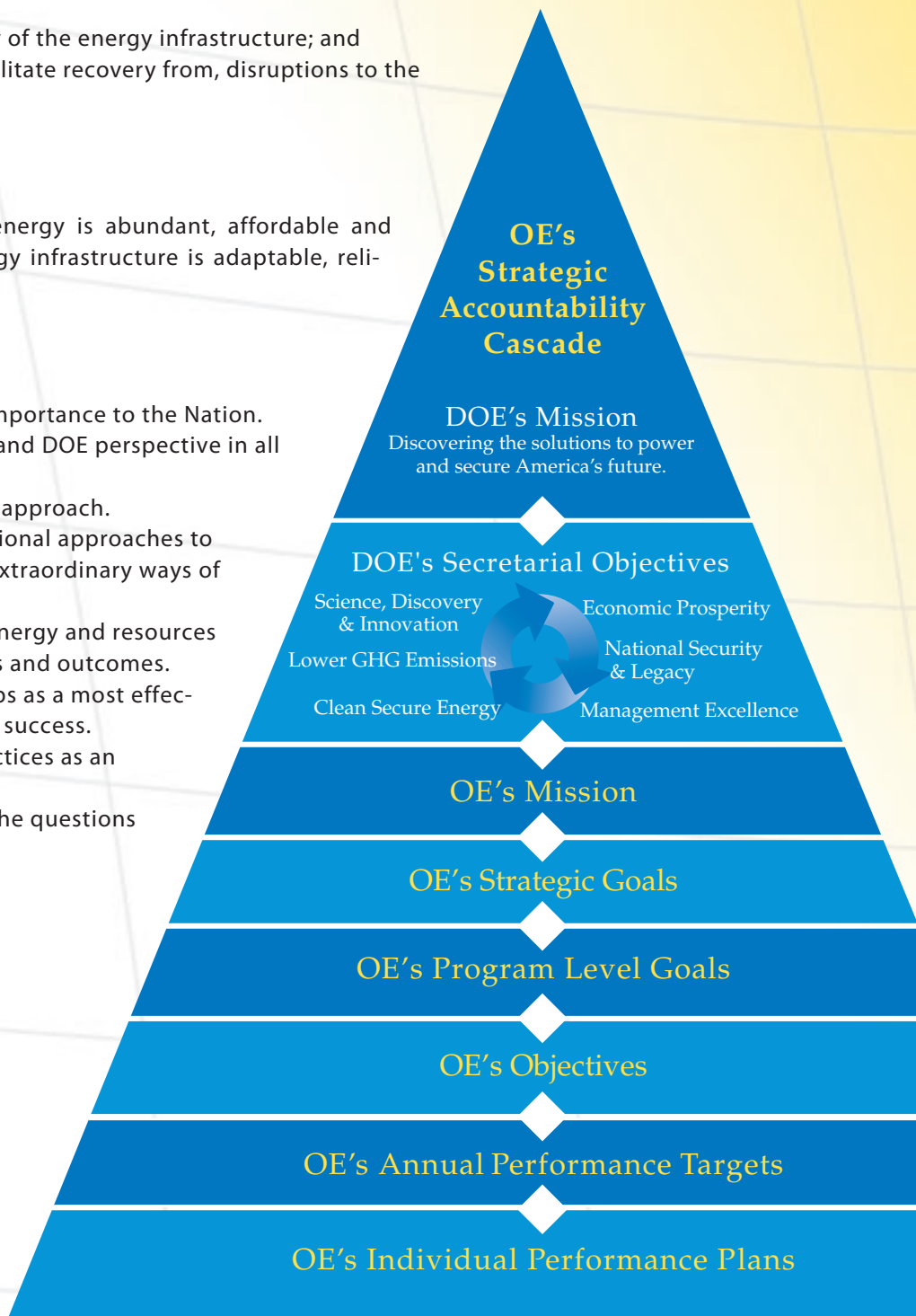
- Modernize the electric grid;
- Enhance security and reliability of the energy infrastructure; and
- Mitigate the impact of, and facilitate recovery from, disruptions to the energy supply.

Vision

OE envisions a future in which energy is abundant, affordable and clean, and one in which the energy infrastructure is adaptable, reliable, and resilient.

Guiding Principles

- Embrace OE's Mission and its importance to the Nation.
- Strive to imbue an office-wide and DOE perspective in all that we do.
- Commit to a solution-oriented approach.
- Strive to think beyond conventional approaches to discover truly innovative and extraordinary ways of addressing OE's challenges.
- Systematically leverage time, energy and resources in our pursuit of desired results and outcomes.
- Embrace teams and partnerships as a most effective methodology to achieving success.
- Strive to demonstrate best practices as an example for others.
- Be willing and unafraid to ask the questions "What if?" and "Why not?"



Achieving Energy

OE's Mission is to lead national efforts to modernize the electric grid; enhance security and reliability of the energy infrastructure; and mitigate the impact of, and facilitate recovery from, disruptions to the energy supply.

To pursue this mission, the office is organized into three programmatic divisions — Research and Development (R&D), Permitting, Siting and Analysis (PSA), Infrastructure Security and Energy Restoration (ISER) as well as a support division, Corporate Business Operations (CBO).

This collaborative structure, as illustrated in the figure to the right, uniquely enables OE to bring together technology, policy and operations to address America's increasingly dynamic energy needs and advance our Nation's energy economy.

Research and Development Division (R&D)

The Office's Research and Development subprogram advances technology, in partnership with industry, government, national laboratories, and universities, to meet America's need for a reliable, efficient, and resilient electric power grid. Its work leads to technologies that contribute to energy independence, greenhouse gas emissions reduction, and economic growth by improving the reliability, energy efficiency, system efficiency, and security of the Nation's electricity delivery system. It undertakes activities that will: (1) strengthen electricity grid stability and reduce the frequency and duration of operational disturbances; (2) increase efficiency of the electric delivery system through reduced energy losses; (3) reduce peak electricity load at distribution feeders, increase asset utilization, and improve accessibility to a variety of energy sources for generation; and (4) harden the energy infrastructure so it can detect, prevent, and mitigate external disruptions to the energy sector. Refer to pages 9-12 for information regarding R&D's technology successes, as well as pages 5-6 with regard to Smart Grid and the Recovery Act.

Permitting, Siting and Analysis Division (PSA)

PSA implements the electricity grid modernization requirements of the Energy Policy Act of 2005. The division assists States, regions, and other Federal agencies to develop and improve policies, market mechanisms, regulations, State laws, and programs that facilitate the development of the electricity infrastructure required to access clean energy resources. PSA also issues permits for cross-border transmission lines and authorizes electricity exports. Refer also to pages 5-6 with regard to PSA's efforts under the Recovery Act.

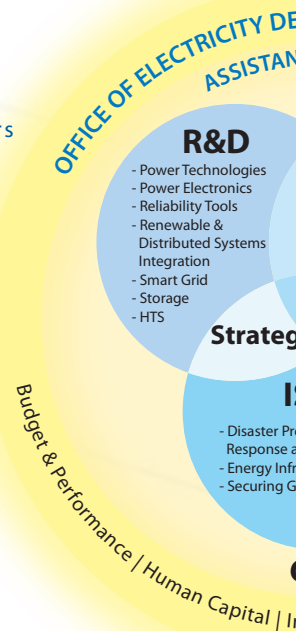
Infrastructure Security and Energy Restoration Division (ISER)

ISER's mission leads the nation's effort to enhance the energy infrastructure's reliability, survivability and resiliency. This division is responsible for assisting Federal agencies, State, Tribal and local governments, and private industry with energy assurance planning, disruption preparation, and

DOE Stakeholders

Congressional Stakeholders

Other Agency Stakeholders



Reliability Together.

response and recovery capabilities; coordinating the Department's response to energy emergencies; and applying DOE's technical expertise to ensure the resiliency of critical energy infrastructure domestically and abroad.

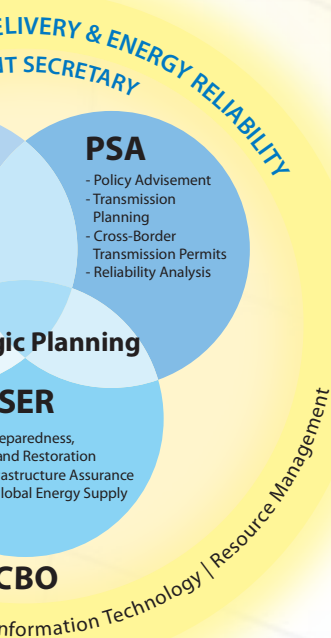
The Division is responsible for enhancing the preparedness and resiliency of critical energy assets and does so by assisting public and private partners with activities in support of Homeland Security Presidential Directives 7 and 8. Improving the resiliency of the energy sector in the face of both manmade and natural disasters is an enduring effort that requires continued vigilance, contingency planning, education and training. ISER works with other Federal agencies, State, Tribal and local governments, international partners and infrastructure owners and operators to enhance personnel, physical and cyber preparedness, collaborate in the development of energy assurance planning tools for State Governors and Legislatures, Tribal and local government officials, and conduct/participate in national, regional and local energy sector emergency exercises to test information sharing, communications and response procedures.

ISER plays an integral role in the larger DOE responsibility for ensuring the reliability of the Nation's energy supply through restoration and recovery actions. Under the National Response Framework, ISER is designated as the lead office for executing the Emergency Support Function #12 – (Energy), facilitating the assessment, reporting, and restoration of damaged energy systems and components. As such, the approach is to leverage a coordinated integration of several DOE capabilities and resources to emergency response situations. This approach enables ISER to provide support for a range of emergency events with a relatively small footprint, while integrating a number of different mission support areas.

Additionally, the Division's energy sector experts and security partners in government and the private sector work together to develop and execute a scalable suite of energy infrastructure support products, designed to enhance U.S. efforts to identify, prioritize, assess and assist key allies in mitigating the risks posed to critical energy sector assets located outside of the U.S. To this end, ISER, in collaboration with Department of State, has used a collaborative process to work with U.S. agencies, friendly foreign governments and international organizations to enhance security and reliability of foreign energy systems, assets, and products that may affect the global stability of the energy system.

Corporate Business Operations (CBO)

This Division provides the administrative, budgetary, financial, human capital, information technology, logistical, communications and performance tracking support that allows OE to achieve its mission and goals in the most strategic and cost-effective manner. CBO's strength lies in its business practices which have led to past successes and will prepare the office for managing current and future challenges, including the Recovery Act. Perhaps the two most important of these business practices are: 1. effective, transparent and responsible use of limited resources; and, 2. embracing a corporate approach closely aligned with DOE. These practices require CBO to build teams and partnerships within DOE, and with other Federal agencies, and the private sector, as well as to oversee alignment of programmatic goals with DOE and OE Mission and strategic goals.



OE: Contributing to Our Nation

Overview of the American Recovery and Reinvestment Act of 2009 (Recovery Act)

The American Recovery and Reinvestment Act of 2009 (Recovery Act) – which President Obama signed into law on February 17th, 2009 – is an extraordinary response to a domestic crisis unlike any since the Great Depression, and includes measures to modernize our nation's energy and communication infrastructure and enhance energy independence.

The Recovery Act includes \$4.5 billion for the Office of Electricity Delivery and Energy Reliability. As outlined in the legislation, these funds are an investment in a nationwide plan to modernize the electric grid, enhance security of U.S. energy infrastructure and ensure reliable electricity delivery to meet growing demand.

This represents a significant increase in the Department of Energy's investment in grid modernization and reflects a recognition that a more efficient and integrated Smart Grid is integral to achieving President Obama's goals to significantly increase the use of renewable energy resources and to improve the Nation's economic future.

The funds primarily support implementation of the Smart Grid programs authorized by the Energy Independence and Security Act of 2007. These include the Smart Grid technology research, development and demonstration projects authorized in the Energy Independence and Security Act Title XIII, section 1304, and the Federal matching funds for Smart Grid technologies in section 1306. A significant share of the funds will be used to support these programs through a competitive process.

As President Obama stated,
“The investment we're making today
will create a newer, smarter electric
grid that will allow for broader use of
alternative energy.”

February 17, 2009



on's Recovery

Activities Created with Recovery Act Funding - \$4.5 Billion

1. **SMART GRID INVESTMENT GRANT PROGRAM:** Create a competitive, merit-based matching grant program that will cover up to fifty percent of investment planned by electric utilities and other entities for deployment of Smart Grid technology, including smart meters, customer-side smart appliances and equipment, demand response measures, distribution and transmission system monitoring and control, and information network systems.
2. **SMART GRID DEMONSTRATION PROJECTS:** Fund competitively awarded financial assistance projects for: 1) regionally unique Smart Grid demonstration projects, which aim at providing regional solutions and best practices in implementing Smart Grid technologies; and 2) electrical energy storage demonstration and development projects, which aim at rapidly advancing market readiness of utility-scale storage technologies in the United States.
3. **WORKFORCE DEVELOPMENT:** Address new and different skills required for the American energy/green workplace to lay the foundation for our long-term competitiveness, including retraining of dislocated workers, thereby strengthening urban and rural communities, rebuilding a strong middle class and protecting the health of our citizens and planet.
4. **INTEROPERABILITY STANDARDS AND FRAMEWORK:** In cooperation with NIST, support development and implementation of interoperability standards and framework ensure effective and consistent application of Smart Grid technologies.
5. **INTERCONNECTION TRANSMISSION PLANNING AND ANALYSIS:** Conduct a resource assessment and analysis of future demand and transmission requirements.
6. **STATE ASSISTANCE ON ELECTRICITY POLICIES:** Augment the staff and capabilities of state public utility commissions and thereby enable them to handle the new, large, time-sensitive workload of considering and approving utility expenditures on Smart Grid technologies.
7. **ENHANCING STATE AND LOCAL GOVERNMENT ENERGY ASSURANCE:** Support a one-time effort to establish the framework and set the momentum for States and local governments to have well-developed energy assurance and resiliency plans they can rely on during emergencies.





OE SUCCESSES

SYNCHROPHASORS TO ENHANCE GRID RELIABILITY 2009

On August 14, 2003, a cascading power failure left 50 million people in the north-eastern United States and eastern Canada in the dark. It was the largest blackout in American history and prompted calls for better ways to monitor the nation's electric power system.

Through the collaborative leadership efforts of the Office of Electricity Delivery and Energy Reliability (OE), the North American Electric Reliability Corporation (NERC) and electric utility companies, deployments of new sensors called phasor measurement units (PMUs) at strategic locations now provide simultaneous measurements of voltage, current and frequency across a wide area of the grid. Phasors provide operators with a faster means to take the pulse of the nation's electric power grid. Phasors also describe the differences in timing between the crests of the waveforms that characterize electrical power as it travels through the lines.

“If we had phasors in place then, we would have been able to see very clearly at least 30 minutes before that event that we were in trouble,” said Stan Johnson,

a manager at NERC, which is responsible for situational awareness and security of the electric power infrastructure. NERC sets mandatory reliability standards for how the North American electric grid is managed and enforces grid operator compliance with these standards.

“If we had phasors in place then, we would have been able to see very clearly that we were in trouble. Thirty minutes would have been enough time to take corrective action. We probably would have wound up shutting the lights off in the Cleveland, Ohio, area, but at least [the blackout] would not have steam-rolled all the way across the Northeast,” Johnson said.

Power once came from relatively local sources. Now, with open transmission access, electricity from inexpensive or renewable sources that might be located in remote areas can be transmitted over long distances to densely populated regions with high power demands. As a result, bulk power systems are operating much closer to their limits of transmission throughput and capacity.

Phase angles have long been used to assess the health of the grid, but these values were calculated from other measurements. The use of the satellite Global Positioning System (GPS) timing function keeps all the phasor PMUs across the grid in precise synchronism, which proved to be a breakthrough with phasor measurements. Using synchronized measurement devices placed directly on the lines and taking samples numerous times each second, voltage phase angles can now be reported in real time instead of requiring calculations, providing an instantaneous picture of the state of the grid. DOE, NERC and utility industry efforts continue to improve phasor technology and implement the use of phasor measurements throughout the thousands of miles of electric power lines.

OE SUCCESSES



2009 OE Superconductivity for Electric Systems

Project Wins 2009 R&D 100 Award: A low AC loss superconducting wire platform developed by the Oak Ridge National Laboratory (ORNL) titled "Superconducting Wires by Epitaxial Growth on SSIFFS™" has been selected as a winner of the 2009 R&D 100 Awards. The Structural Single-Crystal Faceted Fibers (SSIFFS™) template developed by ORNL has the potential to overcome a major technical barrier of superconducting wire in practical AC power applications, namely, AC losses.

2009 Complete the AEP/CERTS Microgrid demonstration to collect real-time data on the operation and level of power quality of CERTS-compatible 100 kW micro source (CHP and emergency backup) to enhance the commercializing of the uninterruptible power supply functionality of the CERTS Microgrid.



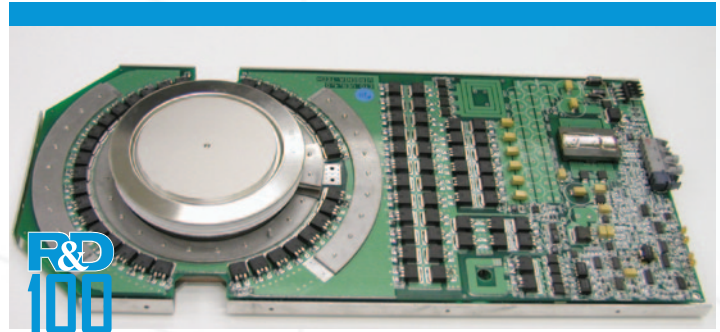
2009 OE's MELCOT Technology Wins 2009 R&D 100 Award:

Jointly developed by the Oak Ridge National Laboratory (ORNL), Electric Power Research Institute (EPRI), Tennessee Valley Authority (TVA) and PBS&J, this innovative technology titled "MELCOT: Methodology for Estimating the Life of Power Line Conductor-Connector Systems Operating at High Temperatures" predicts the service life of conductor-connector systems in electric power transmission systems. Because splices connecting the conductor lines are literally the weak links, this new method of investigating performance and integrity of the power line systems will enable researchers to develop more durable and reliable systems for the electric power grid. This will in turn allow power grid operators to maintain power flow and prevent potential grid failures, and more effectively reroute power distribution during emergency or natural disasters. Funding for this research is provided by DOE-OE, EPRI and ORNL.

2009 Smart Grid System Report: The Department released the first Smart Grid System Report that documents the status of Smart Grid deployments nationwide by employing 20 metrics for indication of deployment progress and identifies regulatory, technical and government challenges to continued deployment. The report, as stipulated under the Energy Independence and Security Act Title XIII, section 1302, is to inform Congress, energy stakeholders, and the public about Smart Grid efforts and will be produced every two years thereafter.

What is an R&D 100 Award?

R&D 100 Awards sponsored by R&D Magazine help companies provide the important initial push a new product needs to compete successfully in the marketplace. Winning an R&D 100 Award provides a mark of excellence known to industry, government, and academia as proof that the product is one of the most innovative ideas of the year.



2009 Power Electronics Device receives R&D 100 Award: The DOE Energy Storage Program managed by Sandia National Laboratories, in partnership with Arkansas Power Electronics International, Rohm Electronics, and the University of Arkansas, received an award for developing the first high-temperature silicon carbide power module. Silicon-carbide-based components such as this one, which has a rated operating temperature of 250 °C, will allow power electronics system designers to reduce the size and weight of their systems by an order of magnitude over systems that use traditional, silicon-based components. System energy losses can be reduced by more than 50%. Smaller, lighter, more efficient power systems made with these new components are less costly and expected to help increase market-penetration of green technologies (e.g., electric vehicles, renewable generation, and energy storage).

2009 Interactive Energy Roadmap: The Department created an online collaborative tool, the interactive energy Roadmap (ieRoadmap), that can be found at www.controlsroadmap.net. The online tool documents cyber security projects in government, academia, and industry, and maps them to specific challenges and priorities identified in the energy roadmap. So far, more than 60 projects have been mapped by 21 organizations, and many are beginning to produce tangible results. The site has also become a hub for news, information sharing, and collaboration within the cyber security community.

2009 Frequency Regulation Facility Contract Signed: On Feb. 23, 2009 in Tyngsboro, MA, Beacon Power and American Electric Power (AEP) signed an agreement to build the first energy storage facility to provide frequency regulation services on a commercial basis. AEP will contribute the site and certain integration services, while Beacon will construct the facility. When the 1-megawatt flywheel system is installed and connected, Beacon will begin providing regulation services directly to the mid-Atlantic region system operator and earning commercial revenue from such services. The system is based on the success of two 100kW pioneering units supported jointly by DOE, the California Energy Commission and the New York State Energy Research and Development Authority as well as the design of a 20MW facility funded by DOE. Regulation by fast storage is at least twice as energy efficient as using fossil fuel generation for this purpose. It also reduces the carbon footprint by some 70%. Widespread adoption of flywheel and battery technology for this application can be expected in the near future.

2009 Critical Asset Maps: Advanced Network Toolkit for Assessments and Remote Mapping (ANTFARM): Energy utilities now have a free, open-source tool to map and visualize their control systems networks — a critical step in meeting the North American Electric Reliability Corporation's Critical Infrastructure Protection standards. By remotely analyzing multiple sources of network information, ANTFARM uses existing tools to map network connections, outline a security perimeter, and visualize critical cyber assets and vulnerabilities within the perimeter. Released by Sandia National Laboratories in 2008, ANTFARM has been downloaded more than 100 times, and enterprise security solution providers are interested in maturing it into a commercially available product.





2009 Megawatt Storage at Long Island Bus Depot Commissioned:

The first U.S. customer-side sodium sulfur storage facility was commissioned in 2009 in partnership with the New York State Power Authority. The 1 MW facility is situated at a natural gas refueling depot of the Long Island Bus company. The facility stores off-peak power at night and uses it during peak periods to run gas compressors for 6 hours. The project is expected to save about \$46,000 a year in utility bills and an additional \$220,000 annual savings in labor costs while reducing peak load for the utility. The facility was funded under a joint New York State Energy Research and Development Authority/OE initiative. DOE will continue monitoring and analysis of the system.

2009 New Battery with Dramatically Increased Cycle Life to Market:

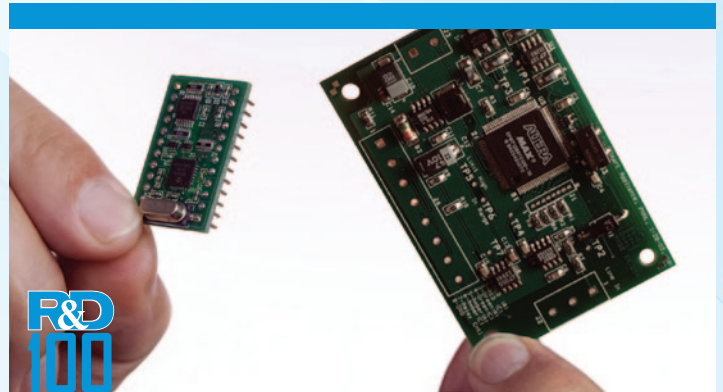
OE has been working in collaboration with an Australian laboratory to test a new lead-carbon battery. Extensive bench tests at Sandia National Laboratories sponsored by OE show a six fold increase in cycle life compared to quality lead-acid batteries. The resultant batteries are comparable to Lithium-Ion batteries, but at a third the cost. DOE is working with East Penn Manufacturing, one of the biggest U.S. battery companies, to produce the battery in its Pennsylvania plant. Production will begin in mid-2010, creating an estimated 300 to 500 jobs during the next two to three years. The new battery should be applicable to many vehicular and stationary applications. Coordinated mega-watt (MW) scale field tests of the new device are already being planned in the U.S. and Australia.

2009/2008 Advanced Smart Charger Technology for Plug-in Hybrid Electric Vehicles (PHEV): In 2008 R&D completed the design of a smart charger for plug-in hybrid electric vehicles (PHEV) and a charger testbed, with definitions and specifications for the full set of control strategies to be implemented in the charger. In 2009 development continued with the completion and testing of a prototype smart charger for PHEVs with smart charging control strategies, ready for one to two vehicle pilot testings.

2009/2008 Renewables Integration: Completion of the Phase 1 report for Western Governors' Association's Western Renewables Energy Zone (WREZ) project. This effort (jointly funded by R&D and PSA, along with EERE involvement) exemplifies the siting and permitting cooperation needed at the State, regional, and Federal levels to address our energy challenges and to achieve the Administration's long-term energy vision.

2009/2008 Hawaii Clean Energy Initiative: Formation of working groups, and completion of technical feasibility study for inter-island cabling in Hawaii. In order for Hawaii to successfully achieve the transformation from an economy that is reliant on 90% fossil fuels to one that is based on nearly 70% renewables, radical changes in energy use, production, and delivery must occur. This study (involving both OE and EERE) is the foundation for understanding the technical limitations to renewables deployment, and the ability to integrate and leverage the State's entire portfolio of energy-rich natural resources.

2008 Real-Time Fault Indicator: ComEd and its partners, Landis+Gyr, DC Systems and Schweitzer Engineering Laboratories, Inc., created the over-head fault indicators with communications capabilities for automated remote reporting. Each device relays information to a central monitoring station, which can then dispatch a repair crew to the fault location and restore power promptly. The remote reporting capabilities reduce the time required for locating power outages, thus resulting in a smarter grid and improved reliability metrics. This real-time fault indication project, sponsored by the OE-supported GridApp™ utility consortium, received the Utility Automation & Engineering T&D 2008 Project of the Year Award in the category of Best Transmission & Distribution (T&D) Automation Project.



2008 Grid Friendly Appliance™ Controller: The GFA Controller developed by Pacific Northwest National Laboratory is a small circuit board built into household appliances that reduces stress on the power grid by continually monitoring fluctuations in available power. During times of high demand, appliances equipped with the controller automatically shut down for a short period of time, resulting in a cumulative reduction that can maintain stability on the grid. The GFA Controller received an R&D 100 award in 2008 and a Federal Laboratory Consortium award for Excellence in Technology Transfer in 2007.



2008 Transmission Level HTS Cable Energized: Energized the world's first ever transmission level high temperature superconducting (HTS) cable in a commercial power grid. The 138 kilovolt cable, located in Long Island, New York, was commissioned on April 22, 2008 and has the potential to carry enough power to serve the equivalent of 300,000 homes. The cable system contains hair-thin, ribbon-shaped HTS wires that conduct 150 times the electricity of similar sized copper wires. This power density advantage enables transmission-voltage HTS cables to utilize far less wire and yet conduct up to five times more power - in a smaller right of way - than traditional copper-based cables. At nearly half a mile in length, it is the longest HTS cable system in the world.

OE SUCCESSES



2008 Albany Superconducting Power Cable with World's First cable section comprised of coated conductor wires was successfully re-energized: Re-energized a 34.5 kV, 350 m cable at National Grid Albany, New York after replacing a 30 meter cable section with second generation (2G) HTS wire. This cable project was the first in the world to use 2G wire in a commercial power grid. The cable operated for over 12 months, 3 months in the hybrid configuration.

2008 World's First demonstration of nano-engineered ordered defects in commercial superconducting coated conductor wires: DOE's Oak Ridge National Laboratory (ORNL) has collaborated with SuperPower Inc. to develop and demonstrate the incorporation of nano-engineered ordered defects into SuperPower's commercial second-generation coated conductor wire (2G wire) manufacturing process. Pioneered by ORNL, the introduction of self-assembled nano-dot columns within a superconducting matrix can significantly improve the performance of 2G wires. Using SuperPower's commercial metal-organic chemical vapor deposition (MOCVD) process, the team has improved the critical current of prototype 2G wires by 170% at 77 Kelvin and 1 tesla magnetic field, and has integrated this process into SuperPower's commercial long-length wire manufacturing procedure.

Cyber Assessments at DOE National SCADA Test Bed (NSTB) Yield Hardened SCADA Systems: Forty-nine more secure, hardened Supervisory Control And Data Acquisition (SCADA) and energy management systems are now in the market—place thanks to on-site and test bed vulnerability assessments conducted by the NSTB. Since 2003, this unique national resource encompassing state-of-the-art research capabilities from five national laboratories, has worked with vendors and asset owners to assess the majority of commercially available systems in the electric and oil and natural gas sectors for cyber vulnerabilities, develop mitigation strategies, and validate their solutions.

Recognizing the value of the NSTB, asset owners are not only downloading system upgrades and deploying hardened systems, they are requesting additional assessments and engaging in assessment specification and funding. Twelve utilities from the U.S. and Australia have formed a consortium with the vendor ABB to privately fund NSTB follow-on testing of the systems they use. These utilities actively participate in specifying testing requirements. Following this model, other users have now developed a similar consortium to co-fund follow-on testing.

2008 U.S. energy security is a national imperative and is therefore in our Nation's interest to work towards improving the security of the global energy infrastructure. As the nation's lead Agency for the Energy Sector, DOE and this office have been given the responsibility to work in collaboration with the our Federal interagency partners to assist strategic international partners and government agencies. OE has entered into several formal agreements with our international partners and is taking proactive steps towards enhancing the countries energy infrastructure and the reliability, survivability and resiliency of the global energy system through the application of physics-based modeling and simulation developed by our national labs.

2008, Developed the Energy Sector-Specific Plan which serves as an annex to the Department of Homeland security's National Infrastructure Protection Plan. This plan was prepared in a coordinated effort with private industry thru the Sector Coordinating Councils for electricity and oil and natural gas as well as the Federal government interagency in the form of the Energy Government Coordinating Council. It is this plan that works to enhance the reliability, survivability and resiliency of our nation's energy sector.



2008 The recently built ERC was utilized to provide near-real time situational awareness, produce leading-edge visualization and modeling and to manage information flow from multiple response locations. The ERC is also used to conduct status briefs to high-level partners including the White House, the Secretary of Energy, and other cabinet level officials. The Center serves as the single point of reference for tracking energy disruptions and for status updates. As it evolves, OE continues to expand the capabilities of the ERC.

2008 OE responded to Hurricanes Gustav, Hanna, and Ike: The consequential timing and landfall locations of Gustav (Louisiana) and Ike (Texas) significantly impacted energy facilities resulting in regional and national consequences. OE personnel facilitated and coordinated mitigation, response and restoration efforts by assisting energy owners and operators with assessing damaged infrastructure through unmanned and manned aerial assessments from various entities. In support of FEMA, OE personnel helped expedite lodging of displaced hurricane victims by creating a work flow energy installation process.

2008 Issued Presidential permit for MATL line-first international line to integrate renewables: OE issued a Presidential permit for construction of a 230-kV transmission line connecting the electric systems of Alberta and Montana in November 2008. DOE, Bureau of Land Management (BLM), and the Montana Department of Environmental Quality cooperated in preparing a single Environmental Impact Statement that was suitable for the needs of each agency. The 203-mile long line (130 miles within the U.S.) is the first international transmission line to integrate renewable generation sources. The entire electrical capacity of the transmission line (300 MW in each direction) within the State of Montana is subscribed by wind power developers. Now that the permit is issued, in spring of 2009, MATL and the Western Area Power Administration agreed to a financing package as part of the American Recovery and Reinvestment Act.

2007 Energy Assurance Guidelines: These guidelines were compiled to assist local governments in preparing energy assurance plans, and to guide local officials in assessing the state of their readiness in the event of a significant energy outage or an event, whether man-made or natural disaster, that leads to a long-term disruption of the local energy supplies. Such planning aids in stabilizing energy supplies and minimizes market impacts.

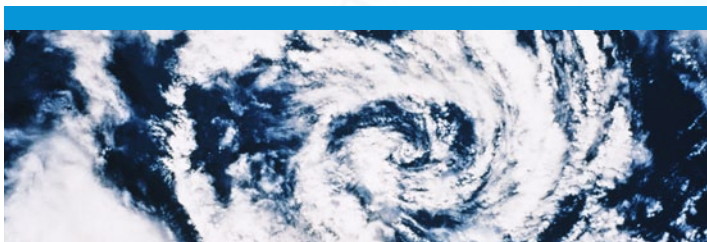
2006 Coordination of Federal Authorizations: Memorandum Of Understanding and Interim Final Regulations: Section 1221(a) of EPAct 2005 added section 216(h) to the Federal Power Act, which requires that DOE act as the lead agency for purposes of coordinating all applicable Federal authorizations and related environmental reviews required to site an electric transmission facility. In August 2006, DOE and eight other Federal agencies entered into a Memorandum of Understanding on Early Coordination of Federal Authorizations and Related Environmental Reviews Required to Site Electric Transmission Facilities.



2006 Congestion Study: In August 2006, the first congestion study was published. PSA is responsible for conducting a study of electric transmission congestion every 3 years. PSA is preparing the second congestion study for publication in August 2009. Based in part on the results of the first Congestion Study, DOE designated two National Interest Electric Transmission Corridors.

2006 OE responders deployed in response to Hurricane Ernesto as well as for a 6.7 magnitude earthquake in Hawaii that cut all power on the islands of Oahu and Maui and much of the power on the Big Island. In addition, responders deployed to the Pacific Northwest when severe wind and snow storms hit following a period of dangerous flooding, resulting in major power outages throughout the region. DOE/OE responders facilitated damage assessment and restoration efforts of key energy systems and components.

2006 Interconnection Standard: Through the OE-supported effort on regional implementation of interconnection standards, five Mid-Atlantic States agreed that all utilities in the region adopt uniform requirements for small generation interconnection based on the ANSI/IEEE 1547 Standard. The uniform interconnection standard requirements will help overcome technical/institutional/cost barriers and help prescribe regional best practices for national adoption.



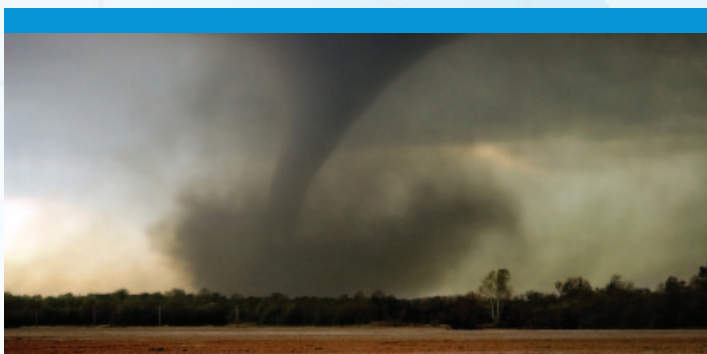
2005, During this unprecedented hurricane season, responders from all across the DOE community deployed responders in response to a record breaking number of storms including the widespread destruction wrought by powerful Hurricanes Katrina, Rita and Wilma. OE responders facilitated the restoration of power to millions of customers and enabled utilities to restore service for their customers by connecting across other providers' service territories. In addition, DOE's expertise was instrumental in averting catastrophic fuel shortages all along the nation's east coast.

Contributed to Western REZ: PSA is the lead on implementation of the electricity grid modernization requirements. This is an ongoing process that includes: acting as the lead agency for coordination of all Federal authorizations required to site electric transmission projects; preparation of a draft programmatic environmental impact statement for the identification of energy corridors on Federal lands in the 11 western states; provision of technical assistance to State public utility commissions and regional electricity organizations on various electricity policy related topics; and preparation of an annual report to Congress on electric industry economic dispatch practices.



2003/2004 Black-out Investigation: In 2003, large portions of the Midwest and the Northeast United States and Ontario, Canada, experienced an electric power blackout affecting an estimated 50 million people in the states of Ohio, Michigan, Pennsylvania, New York, Vermont, Massachusetts, Connecticut, New Jersey, and the Canadian province of Ontario. A PSA staff member and staff from the Federal Energy Regulatory Commission, the North American Electric Reliability Corporation and the Canadian government led a U.S. - Canada Power System Outage Task Force that investigated the causes of the outage and made recommendations for preventing future power outages.

Technical and Financial Assistance to States: PSA provides expert technical assistance on an as-requested basis to the State public utility commissions, State legislatures, regional State associations, regional transmission organizations/independent system operators, Federal officials, and Governors' offices. Topics requiring technical assistance or analysis are: transmission siting; regional resource and transmission planning; and portfolio management.



OE responded to more than 8 natural disasters: Responders provided support and technical expertise to help the energy suppliers and citizens of the Gulf Coast recover from four tropical storms and hurricanes that ravaged the region. OE also deployed for severe Midwest and Northeast ice and snow storms that resulted in widespread power outages throughout the region. OE provided analysis and guidance for volcanic activity in Alaska and for flooding in the Dakota that threatened critical energy facilities. DOE/OE responders facilitated damage assessments and restoration efforts of key energy systems and components.



Our Nation FACES energy challenges

Our demand for electricity is outpacing the ability of our aging electricity grid to deliver adequate and reliable supplies. Bottlenecks and congestion are driving up the cost of electricity, and threatening costly blackouts. Supplies of electricity, oil and gas face the all too frequent specter of disruptions from natural and man-made disasters.

AN ARRAY of to our quality of life...

CLIMATE CHANGE

UNCERTAINTY

RESOURCE ADEQUACY

AGING INFRASTRUCTURE

BLACKOUTS

TERRORISM

WORKFORCE

GLOBAL DYNAMICS

NATURAL DISASTERS

...YET THESE CHALLENGES INVITE OPPORTUNITIES

Sustainable Living Solutions, Energy
Independence, Reliability, Safety & Security,
Green Job Proliferation, Global Leadership &
Energy Infrastructure Resiliency

The challenges of a reliable energy infrastructure can be met by building on public interest and support, growing partnerships and synergies between the government and private sector, demonstrating leadership, leveraging resources, improving productivity, and effectively developing and using innovative technologies and solutions.

Strategic planning – based on sound analysis of these challenges – is OE’s starting point for realizing these opportunities.

OFFICE OF ELECTRICITY DELIVERY
ASSISTANT SECRETARY

R&D

Strategic P

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“THE INVESTMENT WE’RE MAKING TODAY

will create a newer, smarter electric grid that will allow for broader use of alternative energy... This investment will place Smart Meters in homes to make our energy bills lower, make outages less likely, and make it easier to use clean energy... And it’s an investment that takes the important first step towards a national transmission superhighway that will connect our cities to the windy plains of the Dakotas and the sunny deserts of the Southwest.”

– President Barack Obama, February 17, 2009

Achieving Energy Reliability Together.



OFFICE OF ELECTRICITY DELIVERY & ENERGY RELIABILITY

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Learn more about the work of OE and how you can get involved.

RESOURCES:

President Obama's "New Energy For America Plan": www.whitehouse.gov/agenda/energy_and_environment

OE's Role in The American Recovery and Reinvestment Act of 2009: www.energy.gov/recovery/index.htm

"The Smart Grid: An Introduction": www.oe.energy.gov/1165.htm

"Grid 2030 - A National Vision for Electricity's Second 100 Years": www.oe.energy.gov/DocumentsandMedia/Electric_Vision_Document.pdf

Energy Resources for Consumers: www.energy.gov/forconsumers.htm

SmartMeter photo courtesy of Southern California Edison. www.edison.com/smart

TO READ MORE ABOUT THE OFFICE OF ELECTRICITY DELIVERY & ENERGY RELIABILITY'S PROGRAMMATIC DIVISION VISIT:

Research & Development (R&D): www.oe.energy.gov/DocumentsandMedia/RD_Strategic_Plan_Final07.pdf